

first and second coatings can either be the same type of coating, or they can have different properties.

Various objects and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the preferred embodiments, when read in light of the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a cross-section of a roofing shingle having a coating according to the invention.

Fig. 2 is a cross-section of another embodiment of a roofing shingle having a coating according to the invention.

Fig. 3 is a perspective view of a laminated roofing shingle having a coating according to the invention.

Fig. 4 is a cross-section of another embodiment of a roofing shingle having a coating according to the invention.

Fig. 5 is a schematic view of process for coating a roofing material according to the invention.

Fig. 6 is a schematic view of another embodiment of a process for coating a roofing material according to the invention.

Fig. 7 is a schematic view of another embodiment of a process for coating a roofing material according to the invention.

#### DETAILED DESCRIPTION AND PREFERRED EMBODIMENTS OF THE INVENTION

The asphalt-based roofing materials of the invention can be roofing shingles, roll roofing, built-up roofing, or other similar materials. Typically, the roofing materials are embodied as roofing shingles.

The roofing materials include an inner mat which is saturated and coated with an asphalt-based coating. The mat can be any type known for use in reinforcing asphalt-based roofing materials, such as a mat, web, scrim or felt of fibrous materials such as mineral fibers, cellulose fibers, rag fibers, synthetic fibers such as polymer fibers, or mixtures thereof. Preferably, the mat is a nonwoven mat of glass fibers.

5

Except as described below, the "asphalt" used in the asphalt-based coating can be any suitable type of bituminous material, such as an asphalt, tar or pitch. The asphalt can be either a naturally occurring asphalt or a manufactured asphalt,

10

such as an asphalt produced by refining petroleum. The coating may also include other materials, such as fillers, polymers, waxes, stabilizers, pigments, antioxidants, and/or solvents. However, as described below, in certain embodiments of the invention the type of asphalt in the coating, the other materials in the coating, and/or the processing of the coating are specifically engineered for different portions of the coating.

15

The roofing materials of the invention have coatings which vary in composition through the thickness of the roofing materials. The concept is to "tune" the performance of the coating by adjusting its composition through the thickness. This can yield either better performance or less cost with the same

20

performance. The invention provides roofing materials that are optimized as a whole for both performance and cost.

In one embodiment of the invention, the coating on the mat is varied in composition to provide a roofing material that is resistant to algae growth and resistant to premature failure by cracking, while at the same time being reduced in cost. As shown in Fig. 1, a roofing material 10 according to the invention includes a mat 12 saturated and coated with an asphalt-based coating 14. The coating includes a top portion 14A covering the top of the mat, a mat portion 14B saturating the mat, and a bottom portion 14C covering the bottom of the

25

mat. As used herein, "top" means the side facing upward or away from the roof when the roofing material is installed on a roof, and "bottom" means the side facing downward or toward the roof. The roofing material usually includes a layer of roofing granules 16 (not drawn to scale) embedded in the top portion of  
5 the coating.

- The top portion 14A of the coating comprises a mixture of asphalt and rock particles selected from the group consisting of igneous rock particles, metamorphic rock particles, and mixtures thereof. When used as a filler in the top coating, the igneous or metamorphic rock particles provide a roofing material  
10 having resistance to algae growth. These types of rock particles do not support algae growth on the finished roofing material. One reason may be that the igneous and metamorphic rock particles are usually harder than other types of filler materials such as ground limestone. The igneous and metamorphic rock particles are also very resistant to moisture absorption, thereby resisting algae  
15 growth. Many igneous and metamorphic rock particles are also lower in cost than other filler materials.

Any type of igneous or metamorphic rock particles can be used that are suitable as a filler in an asphalt-based top coating 14A. Some nonlimiting examples of suitable igneous rocks include trap rock, granite, basalt, obsidian,  
20 and pumice. Some nonlimiting examples of suitable metamorphic rocks include slate, quartz, amethyst, marble, gneiss, and graphite. Trap rock particles are a preferred type of rock particle for use as a filler in the top coating. The rock particles are usually finely ground particles or powders. Typically, the filler is used in an amount of about 30-75% by total weight of the coating.

25 Although igneous and metamorphic rock particles provide resistance to algae growth, they may cause premature failure (via cracking) of a roofing material when used as a filler throughout the entire coating, presumably due to interaction with the mat. Consequently, the mat portion 14B of the coating is